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FLUORINE-HYDRAZINE PROPULSION SYSTEM

A major step in the development of a 3560-newton (800-pound) thrust rocket engine was taken when JPL engineers successfully used rhenium for the thrust chamber. The rhenium chamber completed a 500-second firing test with no detectable erosion damage as part of NASA's ongoing Space-Storable Propulsion Systems Technology Program.

Rhenium is a refractory metal with good ductility and high-temperature and chemical resistance. It was first evaluated as a liner for a carbon thrust chamber, but an all-rhenium chamber has proven superior in this year's tests.

The goal of the program (sponsored by NASA's Office of Aeronautics and Space Technology) is to prove the feasibility of a fluorine-hydrazine propulsion system for spacecraft application by the end of Fiscal Year 1982. The advanced fluorine propulsion system is designed to be used for Space Shuttle-launched planetary missions from the mid-1980s on.

The fluorine rocket engine's high specific impulse -- 3580 newtons per second for each kilogram of propellant -- can provide the performance required for long-duration missions to any planet in the solar system and for insertion into orbit around planets or their satellites. By combining hydrazine with a cryogenic oxidizer, an indicated performance improvement of 25 percent has been attained over previous liquid fluorine systems such as the Viking Orbiter.

Besides the rocket engine demonstration, this year's advances included fabrication of fluorine-compatible insulation, system thermal design and analysis, and completion of Space Transportation System safety reviews at the Johnson and Kennedy Space Centers.

Figure (*opposite page*): Glowing nozzle of the space-storable rocket engine near the end of a recent 500-second firing test of a thin-walled, all-rhenium thrust chamber. Temperatures of 140 degrees Celsius at the injector end (left) to 1600°C at the nozzle throat were registered. The test series at JPL's Edwards Test Station indicated the rhenium-chambered engine should be capable of over 10,000 seconds of burn.